

## PROBE FOR MEASURING TEMPERATURE IN LIVING BODY

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### Abstract

**PURPOSE:**To enable temp. measurement at many points in a living body with simple and inexpensive constitution by connecting plural piezoelectric vibrators having respectively different resonance frequencies at a specific temp. in parallel with an antenna coil. **CONSTITUTION:**Crystal resonators X1-X5 having respectively different resonance frequencies at a specific temp., for example, 36 deg.C are connected in parallel with an antenna coil L. The probe for measurement constituted in such a way is embedded into a living body and electromagnetic energy of a prescribed frequency is applied via the antenna coil L to the resonators X1-X5. The electromagnetic wave absorption when the resonators resonate is observed.



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## 明細書

### 1.発明の名称

生体内温度測定用プローブ

## Claims

### 2.特許請求の範囲

アンテナ・コイルに圧電振動子を接続したプローブを生体内に埋込み前記生体外から所定周波数の電磁エネルギーを前記アンテナ・コイルを介して前記圧電振動子に与えこれが共振する際の前記電磁エネルギー吸収を観測するか或は前記電磁エネルギーの放射を中止した直後に於ける残響を観測する生体内温度測定法に於いて、前記プローブの圧電振動子を所定の温度に於ける共振周波数が夫々異なる複数個の圧電振動子とすると共にこれらを前記アンテナ・コイルに並列に接続したことを特徴とする生体内温度測定用プローブ。

## Specification

### 3.発明の詳細な説明

本発明は生体内温度測定用プローブ、殊に生体内の温度をその生体内外を結合するケーブルを使用することなく測定する為のプローブに関する。

従来生物学、医学上の研究或は特にガンの治療等を目的として生体内各部の温度を測定する為長期間生体内に埋込んだ無電源プローブと生体外の測定器との間を有線にて接続することなしに測温する方法が提案されている。

上述の如き測温方法としてはアンテナ・コイルに水晶振動子を接続したプローブを生体内の所望の位置に外科的に埋込むか或はこれを消化器内に流すと共に生体外から所要周波数の電磁エネルギーを放射し前記アンテナ・コイルを介して前記水晶振動子に与えこれが共振する際のエネルギー吸収を観測するか或は前記電磁エネルギーの放射を中止した直後に於ける前記水晶振動子の残響を前記アンテナ・コイルを介して受信する手法がある。

しかしながら上記いずれの方法に於いても使用するプローブは特定の温度一周波数特性を有する単一の圧電振動子を備えたものであった

## Specification

### 1.Title of Invention

probe for inside the body temperature measurement

### 2.Claim (s)

probe which connects piezoelectric vibrator to antenna \*coil in inside the body , the electromagnetic energy of specified frequency through aforementioned antenna \*coil , is given to the aforementioned piezoelectric vibrator from pad aforementioned in vitro and when this resonance doing, aforementioned electromagnetic energy absorption is observed or immediately after discontinuing emission of aforementioned electromagnetic energy , at time of inside the body temperature measurement method which observes residual sound , As resonant frequency in predetermined temperature designates piezoelectric vibrator of aforementioned probe as piezoelectric vibrator of respectively different plurality , these probe , for inside the body temperature measurement which designates that you connect to series in aforementioned antenna \*coil as feature

### 3.Detailed Description of the Invention

this invention regards probe in order to measure temperature of probe , in particular inside the body for inside the body temperature measurement without using cable which connects outside the inside the body .

Until recently in order to measure temperature of inside the body section, research on biology , medicine or with therapy etc of especially cancer as objective method which temperature measurement is done is proposed burying without non power supply probe which is packed and connecting between measuring apparatus of in vitro with wired in long period inside the body .

probe which connects crystal oscillator to antenna \*coil as temperature measurement method an above-mentioned way as in desired position of inside the body pad \* or this is let flow into digestive organ in surgical , electromagnetic energy of necessary frequency is emitted from in vitro and through the aforementioned antenna \*coil , is given to aforementioned crystal oscillator and this does resonance time It observes energy absorption, or immediately after discontinuing the emission of aforementioned electromagnetic energy , there is a technique which through aforementioned antenna \*coil , receives residual sound of aforementioned crystal oscillator .

But regarding to above-mentioned any method , as for probe which you use because of those which have single piezoelectric vibrator which possesses specific temperature -

為、1個のプロープにて測温し得る点は1点だけであって、殊に体内に広く転移したガンの温熱治療を行なわんとする場合多数のプロープを埋設する必要があり極めてわずらわしいのみならず患者に与える苦痛も多大なものとなるという欠陥があった。

本発明は上述の如き従来のプロープの欠陥を除去する為になされたものであって、特定温度に於ける共振周波数が夫々異なる複数の圧電振動子を前記アンテナ・コイルに並列に接続した生体内温度測定用プロープを提供することを目的とする。

以下、本発明をその原理と実施例とを示す図面によって詳細に説明する。

第1図は本発明に係るプロープの構成を示す回路図である。

即ち、X1乃至X5は特定の温度、例えば36°Cに於ける共振周波数が夫々10,000MHz、10.010MHz、……、10.040MHzの+5° Yカット水晶振動子でありこれらを夫々アンテナ・コイルLに並列に接続したものである。

上述の如きカット・アングルの水晶振動子は温度が1°C変化するとその共振周波数は第2図に示す如くほぼ1KHz変動するものである。そこで上記第1図に示す如く構成したプロープを生体内所望の位置に埋込み、生体外から所定周波数、例えば10.012MHzの電磁波を前記アンテナ・コイルLに放射したところ当該周波数に於けるエネルギー吸収が詳細説明を省略する体外測定器を構成するエネルギー検出器によって観測されたと仮定すればこれは前記第2図から明らかな如く前記水晶振動子X2の周辺温度が38°Cであることを検知したことを意味することが理解されよう。

術、この際、前記水晶振動子X1が48°C或はX3が28°Cであることも意味するが、例えば人体の組織が耐え得る温度のレンジを参照すればこれらの可能性のあり得ないことは自明であろう。

又、圧電振動子の残響を利用する測温法に本発明のプロープを適用すれば同様に外部から与えられた所定周波数に共振した振動子の減

frequency characteristic, with probe of 1 temperature measurement as for point which it can do with just 1 point, When to be wide heat therapy of cancer which transfer is done line it makes cup in in particular inside the body, it is necessary embedding to do multiple probe there was a defect that also pain which quite is given to the troublesome furthermore patient becomes great ones.

As for this invention being something which can be made in order to remove defect of conventional probe an above-mentioned way, resonant frequency in the specific temperature piezoelectric vibrator of respectively different plural designates that probe for inside the body temperature measurement which is connected to series in aforementioned antenna \*coil is offered as objective.

Below, this invention is explained in detail with principle and drawing which shows Working Example.

Figure 1 is circuit diagram which shows configuration of probe which relates to this invention.

Namely, as for X1 to X5 resonant frequency in specific temperature, for example 36°C these is something which is connected to series in respectively antenna \*coil L with + 5deg Y cut crystal oscillator of respectively 10, 000MHz, 10.010MHz, \*\*\*, 10.040MHz.

As for crystal oscillator of cut \*angle an above-mentioned way when temperature changes 1°, resonant frequency as though it shows in Figure 2, is something which almost 1 KHz variation is done. Then as though it shows in above-mentioned Figure 1, configuration the probe which is done in inside the body desired position pad, When electromagnetic wave of specified frequency, for example 10.012MHz is emitted to aforementioned antenna \*coil L from in vitro that it was observed with energy detector which configuration does outside the body measuring apparatus where energy absorption in this said frequency abbreviates \*minute explanation discernment if supposition it does, as for this although it is clear from aforementioned Figure 2, periphery temperature of the aforementioned crystal oscillator X2 38° being detection It will understand that fact that it does is meant.

At time of technique and this, aforementioned crystal oscillator X1 48° or X3 28° means also fact that is, but if range of the temperature which tissue of for example human body can withstand is referred to, it probably is self-explanatory for these possibility not to be possible.

If probe of this invention is applied to temperature measurement method which utilizes residual sound of also, piezoelectric vibrator, also it probably is clear for attenuation vibration of oscillator which resonance is made the specified

衰振動が観測されることも明らかであろう。

ところで本発明に係るプローブはこれを外科的に生体内に埋込むものにあつては第3図に示す如く生体組織となじみがよくしかも比較的フレキシブルなプラスチック C で包囲する必要がある、斯くすることによって比較的自由に所望の測温点に各圧電振動手を配置することが可能となるものである。

一方、前記アンテナ・コイル L への電磁波放射の方法としては各種周波数の電磁エネルギーを順次与える方法と同時に与える方法とのいずれを用いてもよく前者によれば装置は簡単安価となり後者によれば装置は複雑高価となるが短時間に多点の温度測定が可能となろう。

尚、上述の実施例に於いては圧電振動手を水晶振動手に、又その数を5個としたが本発明がこれらに限定される必然性は全くなく振動手の種類、数も用途によって自由に選択し得ることはいうまでもない。

又、プローブの形状も必ずしも直線的である必要はなく用途に応じて前記アンテナ・コイルな中心に放射状に或は分枝する如く圧電振動手を配置するものであつてもよい。

更に前記圧電振動手列と前記アンテナ・コイルとを分離結合自在の構造とし温度センサたる圧電振動手列を生体内深部に、前記アンテナ・コイルを生体表面近傍に配置して感度を向上し、前記両者を結線用アタッチメントを介して接続するようにしてもよい。

本発明に係る生体内温度測定用プローブは以上説明した如く構成し且つ機能するものであるから極めて簡単安価に構成し得ると共に単一のプローブによって生体内の多数のポイントの温度を短時間の内に測定することが可能となるので生物学或は医学上の研究を行う上でデータ採取能率を向上するのみならず殊にガンの温熱療法を行う際の温度監視システムに適用するならば体内各所に転移したガン組織に対し少数回の外科手術によってプローブを配置することが可能となるので患者に与える苦痛を極限し、同時に多数の転移ガンを治療する上で著しい効果を発揮するものである。

frequency which is given in same way from outside to be observed.

By way as for probe which relates to this invention this in the surgical in inside the body pad \* being in thing, as though it shows in Figure 3, it is necessary for body tissue and conformity furthermore to encircle well relatively with flexible plastic C, relatively it is something where it becomes possible to arrange each piezoelectric vibrating hand freely in desired temperature measurement point, by fact that thus it does.

On one hand, making use of which of method which is given simultaneously with method which sequential gives electromagnetic energy of various frequency as method of electromagnetic wave emission to aforementioned antenna \* coil L according to former well device becomes simple inexpensive and according to the latter device becomes complicated expensive, but temperature measurement of multiple points will become possible in short time.

Furthermore regarding to above-mentioned Working Example, piezoelectric vibrator in the crystal oscillator, in addition number was designated as 5, but there is not inevitability where this invention is limited in these completely and as for can selecting also quantity of types, of oscillator freely with application it is not necessary to say.

As though always it is not necessary to be a linear and the aforementioned antenna \* coil in center or branch it does either the geometry of also, probe in radial according to application, it is possible to be something which arranges piezoelectric vibrator.

Furthermore it designates aforementioned piezoelectric vibrator line and the aforementioned antenna \* coil as separation connection unrestricted structure and temperature sensor barrel piezoelectric vibrator line in inside the body deep part, arranging the aforementioned antenna \* coil in body surface vicinity, sensitivity it improves, it is possible through attachment for connection, to connect the aforementioned both.

Because as for probe for inside the body temperature measurement which relates to this invention as though above you explained, because only configuration it is something which functions, as configuration it can make quite simple inexpensive, it becomes possible with single probe to measure temperature of multiple point of inside the body among short time, when researching on biology or medicine, data recovery If efficiency is case where furthermore moist heat therapeutic method of in particular cancer which improves is done is applied to temperature monitoring system, because it becomes possible to arrange probe with surgery of little several times vis-a-vis cancer tissue which transfer is turned to inside the body various parts when extremity does pain which is given to patient, the

therapy doing multiple transfer cancer simultaneously it is something which shows considerable effect.

## Drawings

### 4.図面の簡単な説明

第1図は本発明に係るプローブの基本構成を示す回路図、第2図はその測温原理を説明する図、第3図は本発明に係るプローブの一実施例を示す断面図である。

X1乃至Xn……………圧電振励子、

L……………アンテナ・コイル

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### 4.Brief Explanation of the Drawing (s)

As for Figure 1 as for circuit diagram, Figure 2 which shows basic constitution of probe which relates to this invention as for figure and Figure 3 which explain temperature measurement principle it is a sectional view which shows one Working Example of probe which relates to this invention.

X1to Xn\*\*\*piezoelectric swing Reiko,

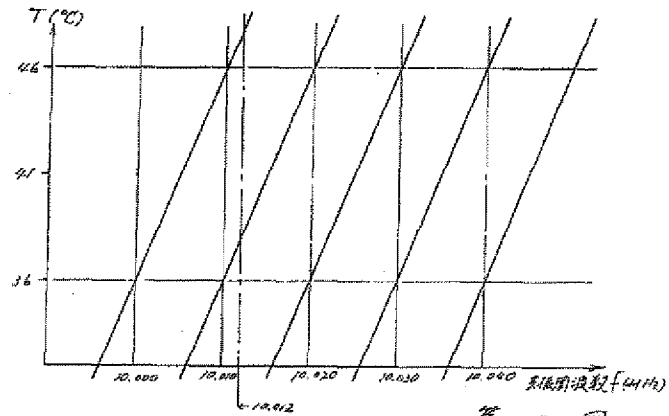
L\*\*\*antenna \*coil

patent applicant Saito Yoshiaki

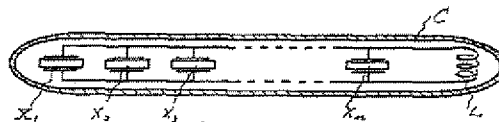
Same Toyo Communication Equipment Co., Ltd.



第 1 図



第 2 図



第 3 図

明.